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An overview on the role and potential of forage production on lowland organic livestock farms

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ABSTRACT

This paper outlines some of the factors influencing the level of forage production on organic lowland farms. Optimal forage production is achieved by maintaining soil fertility, providing a balance between N-fixing and N-demanding crops and producing sufficient quantities of quality feed to meet the requirements of the organic livestock enterprise. A key objective for organic systems is to increase the efficiency of forage production by improving the nutrient input/output balance of the whole-farm system. Improving forage quality reduces the requirement for external feed sources, leading to increased self-sufficiency in the whole-farm system. Legumes provide the main source of nitrogen for forage production with energy shortage and an erratic supply of protein the main limiting factors in the provision of balanced diets from home-grown crops.

Keywords: organic; crop production; clover

INTRODUCTION

Compared to many conventional farms the cropping systems on lowland organic livestock farms have the potential to improve whole-system nutrient budgets and increase the level of self-sufficiency. Organic livestock systems require high-forage diets, increasing the need to ensure quality as well as sufficient quantity is achieved from the production of home-grown forage crops. The criteria for a successful cropping system includes sustaining soil fertility, providing a balance between N-fixing and N-demanding crops, producing quality feed to meet the annual requirements of the livestock enterprise and improving the efficiency of nutrient utilisation. Total dry matter production from the crops grown on the farm should not be the only measure of the output from the rotation. Further evaluation is required to determine the nutritive value of the individual crops and their contribution to the energy, protein and mineral requirements of the livestock enterprise on the farm. Supplying sufficient energy and the correct protein level for the livestock enterprise are a key factors in the management of organic systems, with a deficit of energy from home-grown crops a problem on many farms.

DISCUSSION

The type of cropping system that is established on the organic farm influences not only the level of crop production that can be achieved but also the stocking density and output of marketable products from the system. In an all-grassland system based on grass/clover leys and permanent pasture the total forage

production will generally be 10% lower than in a rotation that includes short-term leys but the forage cost in the latter system may be markedly higher.

Legumes are essential in providing both a high-quality feed and the nitrogen (via fixation) that is required for the production of grass and other crops, with white clover the primary legume used on organic farms. Depending on the level of self-sufficiency clover has the potential to provide 50-80% of the total N-input to the organic livestock system. The clover content of a mixed sward varies between seasons, therefore, as the main source of nitrogen clover will have a marked influence on seasonal variations in the level of herbage production and the stocking density that can be sustained without the need to import additional feed sources into the farm system. A comparison between the forage yields from conventional and organic systems (Weller, 2001- unpublished data) shows that although the clover production and level of N-fixation varies annually within an organic system there is less variability between seasons than in a conventional system based on a constant annual N-input. A limitation of white clover-based swards is the erratic supply of protein (Weller & Copper, 2001) with the protein content of both the grass and clover increasing during the growing season. By early summer the protein content of the sward is higher than the level required by the grazing animal and the excess protein leads to poor utilisation by the animal and an increasing risk of pollution. The late spring growth of clover also shortens the grazing season and reduces the protein content of herbage cut for silage in the late spring period. During the winter period when silage-based diets are fed an extra source of protein will be required to balance the diets of lactating dairy cows. During the summer period when the clover content of the sward is high the fibre content of the grazed herbage is <40% and for animals consuming either herbage alone or herbage supplemented with a concentrate feed the fibre content of the diet will be less than the minimum required by the ruminant animal for efficient feed utilisation (Chamberlain & Wilkinson, 1996). In a mixed sward the grazing animal will select a higher proportion of clover than grass (Parsons *et al*, 1994). Therefore, a high stocking density during the grazing season should be avoided as overgrazing of clover-based swards leads in the following year to a reduction in the clover content, reducing not only the total forage yield (Weller & Cooper, 1995) but also the stocking density and output of marketable products.

Changing from a conventional system based on fertilised ryegrass swards to organic management requires the establishment of clover-based swards to replace purchased fertiliser-N. The major component of seed mixtures grown for grazing and conservation is provided by ryegrass cultivars due to their agronomic and quality characteristics. Achieving optimal forage production is dependent on increasing the quality and the energy value of the forage will be improved by the inclusion in the seed mixtures of the new higher-energy ryegrass varieties that are now available. Conversion of the farm also offers the potential to increase the diversity of the sward by including timothy, meadow fescue, cocksfoot or other species. On conventional farms with higher N-inputs perennial ryegrass usually out yields other grass species. However, in organic systems where N-inputs are lower other species can produce comparable or higher yields (Stevens *et al*, 1992; Weller & Bowling, 2001). In establishing and maintaining mixed swards of grass and clover the compatibility between clover species and the companion grasses needs to be evaluated to ensure the clover to grass ratio is balanced and

not influenced by the dominance of either over-aggressive clover or grass varieties. Depending on the composition of an existing sward an imbalance between the main plant species may be corrected either by a change in the management practice from grazing to conservation or vice versa. Other methods of increasing the population of the recessive species in the sward include oversowing or slot seeding of the appropriate seed. Slot-seeding an early-growing ryegrass into an existing sward during the autumn also provides earlier growth in the following spring, allowing turn-out and the change from silage-based diets to grazed herbage to occur at a similar time to the date recorded on conventional farms.

On many organic farms permanent pastures make a major contribution to forage production and compared to re-seeded leys have a wider diversity of plant species (Bowling & Haggar, 1996) that is similar to the diversity recorded in permanent pastures on conventional farms (Forbes *et al*, 1980). The average yields from permanent pastures have been found to be only slightly lower than those produced from re-seeded swards (Jones & Bowling, 1999). Compared with re-seeded leys the dense sward bottom found in many permanent pastures reduces the problem of poaching and prevents the establishment of large populations of weeds, particularly *Rumex* and other broad-leaved species. In permanent pastures and also medium-term re-seeded swards a number of indigenous grasses, including *agrostis* species and *poa trivalis,* may significantly influence both the diversity and total annual production of forage produced from the sward.

Herb species, including chicory and ribgrass plantain, can significantly increase the availability of minerals in a sward (Weller & Bowling, 2001), improve animal performance (Fraser & Rowarth, 1996) and reduce parasitic problems (Niezen *et al*, 1998). However, establishing and maintaining the herbs in the sward can be difficult due to over-grazing and winter hardiness. Different climatic conditions will also have a marked influence on the type of herbs found in permanent pastures. When herbs are grown in a mixed sward management practices, including both grazing severity and cutting frequency, influence both their persistency and contribution to the total yield of the sward.

While forage for grazing and conservation is primarily produced from grass/clover swards other crops have the potential to increase the feeding quality of the forage. In an organic livestock system where the aim is to achieve a high level of feed self-sufficiency the growing of other crops within the rotation will also be required to replace purchased concentrate feed. Introducing cereal crops into the rotation increases the flexibility of feed supplies as cereals can be conserved as whole-crop silage to provide extra forage, conserved prior to maturity as crimped grain or combined to provide a high-energy grain feed. Cereal crops also have a valuable role in providing a cover crop for the establishment of succeeding crops of grass and clover mixtures. As energy is a limiting factor during the winter period the inclusion of either forage maize or fodder beet in the rotation can increase the energy density of the diets. Depending on the climatic conditions and soil type on the individual farm other legumes, including beans, peas, lucerne and sainfoin can also provide valuable high-quality feed for the organic livestock farm. However, the inclusion of additional crops in the rotation requires an evaluation of

the whole-system nutrient budgets to ensure sufficient on-farm nutrients, including phosphorus and potassium, are available for growing these crops. Halberg *et al* (1995) reported an annual surplus of 124 kg of N/ha on mixed organic farms and providing both optimal legume production is achieved and an effective on-farm manure strategy is implemented, the availability of nitrogen is unlikely to a limiting factor in achieving optimal forage production. Prior to the introduction of other crops into the rotation the implications on costs of production and management requirements need to be evaluated as the disadvantages may outweigh the potential benefits of some new crops.

REFERENCES

Bowling P J; Haggar R J (1996) Changes in biodiversity due to conversion. In*: Conversion to Organic Farming*, eds R J Haggar & S Padel, pp. 66-73. IGER Technical Review Number 4, Aberystwyth, UK.

Chamberlain A T; Wilkinson J M (1996) *Feeding the Dairy Cow*, Chalcombe Publications, Lincoln, UK.

Forbes T J; Dibb C; Green J O; Hopkins A; Peel S (1980) *Report on the factors affecting the productivity of permanent grassland*. Jointly published by the Grassland Research Institute & ADAS, Hurley, Maidenhead, UK.

Fraser T J; Rowart J S (1996) Legumes, herbs or grass for lamb performance*. Proceedings of the New Zealand Grassland Association* **58**, 49-52.

Halberg N; Kristensen E S; Kristensen I S (1995) Nitrogen turnover on organic and conventional mixed farms. *Journal of Agricultural and Environmental Ethics* **8**, 30-51.

Jones E L; Bowling P J (1999) Herbage production. In: Organic milk production: post-conversion phase, IGER Report to MAFF, Part 1: Scientific Report.

Niezen J H; Robertson H A; Waghorn G C; Charleston W A G (1998) Production, faecal egg counts and worm burdens of ewe lambs which grazed six contrasting forages*. Veterinary Parasitology* **80**, 15-27.

Parsons A J; Newman J A; Penning P D; Harvey A; Orr R J (1994) Diet preference of sheep: Effects of recent diet, physiological state and species abundance. *Journal of Animal Ecology* **63**, 465-478.

Stevens D R; Baxter G S; Casey M J, Miller K B; Lucas R J (1992) A comparison of six grasses for animal production. *Proceedings of the New Zealand Grassland Association* **54**, 147-150.

Weller R F; Cooper A (1995) The effect of the grazing management of mixed swards on herbage production, clover composition and animal performance. Proceedings of the British Grassland Society Occasional Symposium Number 29, Harrogate, UK.

Weller R; Bowling P J (2001) The yield and quality of plant species grown in mixed organic swards. In: *Organic meat and milk from ruminants*. Proceedings of the International Conference on Organic Meat and Milk, Athens (In press).

Weller R; Cooper A (2001) Seasonal changes in the crude protein concentration of mixed swards of white clover/perennial ryegrass grown without fertiliser N in an organic farming system in the UK. *Grass and Forage Science* **56**, 92-95.

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